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ABSTRACT

A research project examined the development and use of instructional materials in Finland's schools. Aspects investigated included instructional aims, pupils' entry levels, teaching methods, and evaluation. This document reports on the principal results of the project, and covers the following topics: (1) a brief concept analysis of the instructional materials; (2) teachers' assessments of instructional materials in comprehensive schools; (3) results concerning the availability of automatic data processing (ADP) devices and the conditions for ADP instruction in upper secondary schools; (4) experiences gained by teachers and pupils from instructional materials in course-based upper secondary schools; and (5) the basis for establishing some of the principal criteria for the assessment of instructional materials and rankings of these criteria. (Author/CB)

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RESEARCH BULLETIN 66

Vesa A Niskanen

SOME PRINCIPAL RESULTS OF THE STUDIES CARRIED OUT IN THE RESEARCH PROJECT ON INSTRUCTIONAL MATERIAL

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ABSTRACT

This report is a comprehensive presentation of the principal results of the studies carried out by Vesa A Niskanen in the research project on instructional material conducted by the Department of Education at the University of Helsinki (see references). The following topics will be presented here:

(i) A brief concept analysis of the instructional materials.

(ii) The results concerning teachers' assessments of instructional materials in comprehensive schools.

(iii) The results of a study concerning the availability of ADP devices and the conditions for ADP instruction in upper secondary schools.

(iv) The experiences gained by teachers and pupils from instructional materials in course-based upper secondary schools.

(v) The study mentioned in item (iv) provided the basis for establishing some of the principal criteria for the assessment of instructional materials. The results obtained by examining the rankings of these criteria will be given here.

Keywords: instructional material, comprehensive school, upper secondary school, ADP

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PREFACE

This report is a comprehensive presentation of principal results of the studies carried out by Vesa A Niskanen in the research project on instructional material conducted by the Department of Education at the University of Helsinki. I would like to thank professor Erkki A. Niskanen for the support and valuable advice he has given me. I also thank Ms Päivi Lahdensuo, M.A., for translating this report in English and Mr Eugene Holman, M.A., for revising the English. Finally, I would like to thank professor Anna-Liisa Leino, head of the Department of Education of the University of Helsinki, for accepting this research report into its series of publications.

Helsinki, May 1987
Vesa A Niskanen

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1. INTRODUCTION

1.1. Theoretical background

Since the 1970', comprehensive planning and development has been emphasized in the Finnish educational systems. As regards comprehensive schools and upper secondary schools, the problems related to the realization of education have primarily been considered. The devising process of instructional materials is an essential constituent in this problem area.

In order to examine the foregoing problems, a research project on instructional material was established by the Department of Education at the University of Helsinki in 1977. From the beginning the project has been cooperated with the Instructional Material Bureau of the National Board of Schools.

The general research aims of the above-mentioned project are presented in the research plan (Niskanen, E. & Leino, J: 1977). The principal aim is the examination of the status of instructional material with respect to instructional process. This aim involves that instructional materials will be examined in the light of the following aspects: The aims of instruction, the entry level of pupils, the teaching methods, and the evaluation. The above-mentioned situation is sketched in Diagram 1.

The principal aim comprises various objectives, such as

1. the examination of instructional material as a didactic process,

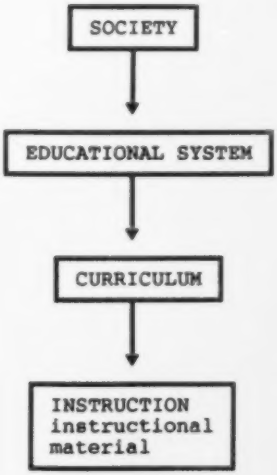
2. the classification of instructional materials,

3. the examination of the planning, production, employment and development of instructional materials, and

4. the development of appropriate criteria for instructional materials.

Hence the project concentrates on basic research as well as on the on applied research and development work. The studies presented below represent the last-mentioned group.

Diagram 1. Status of instructional material with respect to instructional process



1.2. Instructional material

The term 'instructional material' has many different meanings. Here 'instructional aids' and 'instructional materials' are regarded as working aids in the process aiming at learning.

(i) Instructional aids are mostly technical working aids which help make instructional materials more accessible to pupils.

(ii) Instructional material comprises the material concerning information, skill and forms of social intercourse intended for pupils within the framework of educational objectives.

Instructional materials may be classified into three categories:

(i) Literary materials, such as textbooks, work books, exercise books, supplementary reading materials, teachers' guide and hand-outs.

(ii) Audio-visual materials, such as slides, transparencies, educational films, videotapes, and radio and television program.

(iii) Learning games and similar material.

Today the various kinds of automatic data processing (ADP) program applied to teaching may also be included in the above-mentioned categories. The foregoing broad definition of instructional material has been accepted by the Committee on Instructional Material (Committee report: 1973).

Despite the fact that the present legislation grants every Finnish citizen the right to produce instructional materials, they are de facto mainly produced by:

(i) publishing houses

(ii) some offices and institutions of the State

(iii) specialized audio-visual material shops

(iv) central organizations, industrial organizations, cultural organizations etc.

(v) The Finnish Broadcasting Company

(vi) other producers (e.g. schools)

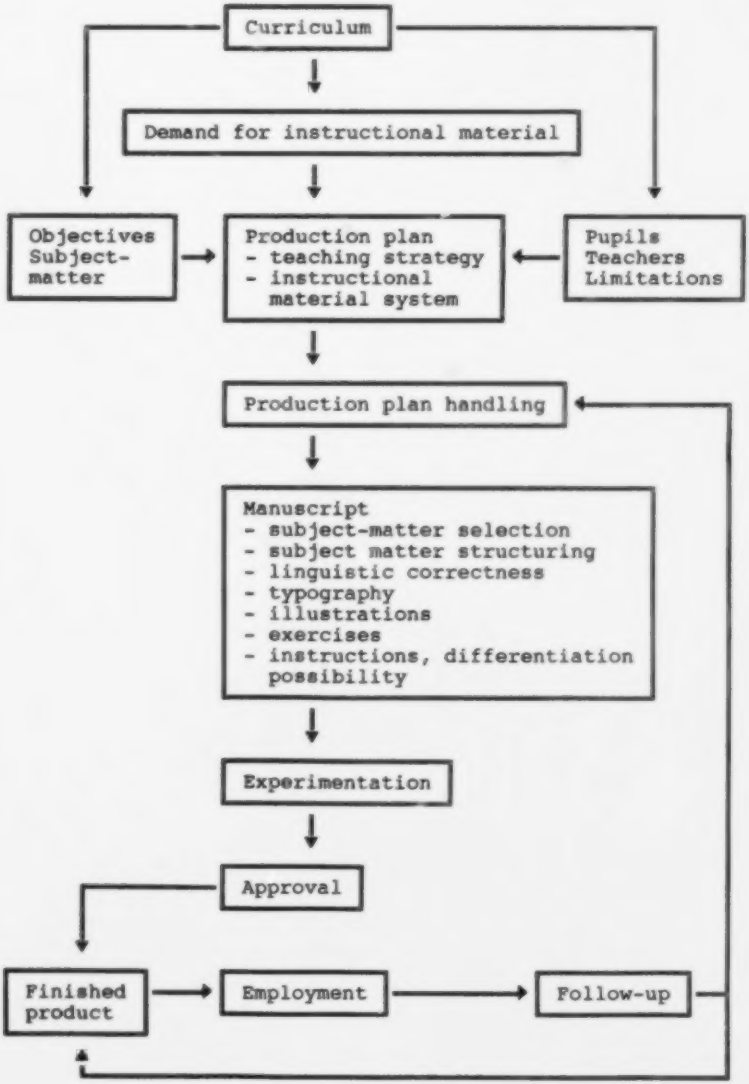
The Instructional Material Bureau of the National Board of Schools deals with the material used in comprehensive and upper secondary schools in Finland. In schools following the comprehensive school curriculum, for example, only textbooks approved by the National Board of Schools may be used.

The process of devising instructional material generally comprises the stages presented in Diagram 2 (Niskanen, E. & Leino, J: 1977).

The most frequently used instructional material is still the textbook. Each year more than 10 million comprehensive school textbooks are produced. There are approximately 630,000 comprehensive school pupils.

Audio-visual materials may be hired from State audio-visual material centers, certain private sources (enterprises, foreign embassies etc.) and others.

Diagram 2. The process of devising instructional material



2. RESEARCH CONCERNING COMPREHENSIVE SCHOOLS

A study on the instructional materials used in comprehensive schools was carried out in 1979 (Niskanen, V: 1980). The main problems investigated were:

1. How are instructional materials used for teaching in comprehensive schools?

2. What are the experiences which have been gained from comprehensive school instructional materials?

Due to the extensiveness of these problem areas only the following subjects were examined:

(i) mathematics

(ii) Finnish (mother tongue)

(iii) religion

(iv) second language.

Furthermore, only the third, fifth, seventh and ninth grades out of a total number of nine grade-levels were studied.

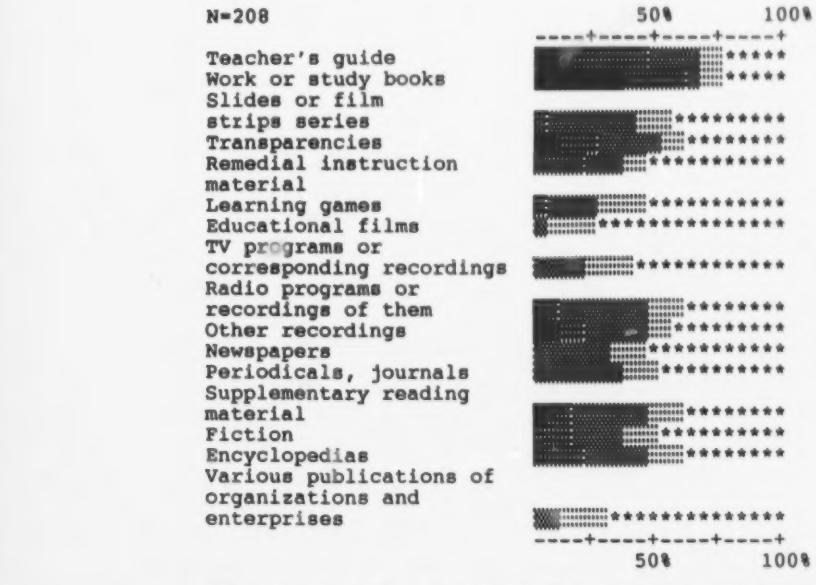
Two hundred and fifty teachers from different parts of the country were selected for the sample. Principals of the schools studied made the ultimate selection of the teachers according to the instructions they have been given.

2.1. General results

The form was returned by 208 teachers (83.2 %). Of these, 64.4 % were female. The distribution of the respondents was quite even as to the selected subjects. The number of years of services was highest among mother tongue teachers (on an average 17 yrs.) and lowest among second language teachers (approx. 9 yrs.).

As the textbook was known in advance to be a very essential instructional material, no inquiry about its use was made. As pertains to supplementary materials the results are presented in Figure 3.

Figure 3. Employment of supplementary materials, all subjects (%)



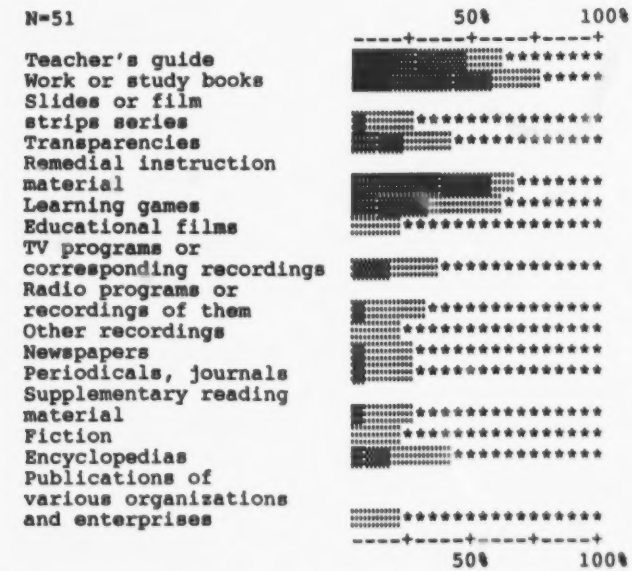
(▓ : daily, ▒ : weekly, ▓ : a few times a term, ▒ : less frequently, * : not available; one symbol means 5 %)

The books distributed to pupils were not returned afterwards, but the pupils were allowed to keep them. The teachers' opinions about this were asked since this practice increased the cost of instruction. Out of the 198 teachers who answered, 35.4 % were for and 64.6 % were against books being returned; with teachers of religion being most inclined (54.6 %) in this direction.

2.2. Mathematics

Fifty-one mathematics teachers answered the inquiry. They had books from four different publishers at their disposal. The use and importance of supplementary materials in mathematics instruction are presented in Figures 4 and 5 respectively.

Figure 4. Employment of supplementary materials in mathematics (%)



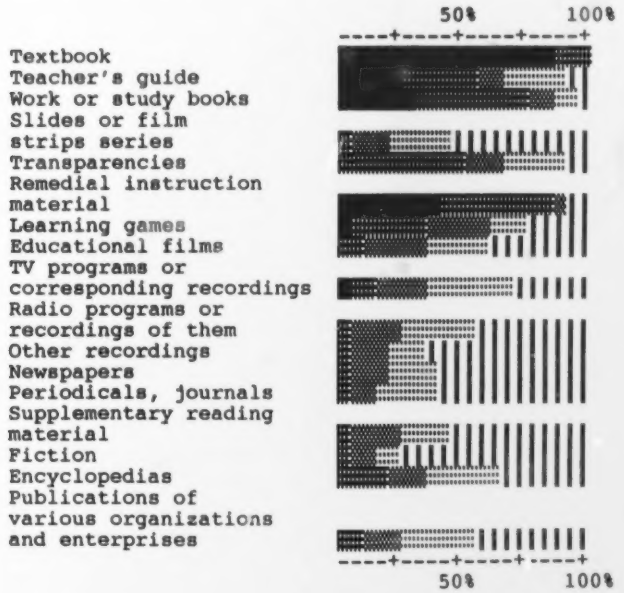
(▓ : daily, ▒ : weekly, ▒ : a few times a term, ▒ : less frequently, * : not available; one symbol means 5 %)

Comparison of the Figures 4 and 5 seems to indicate that there is a shortage of some types of instructional material; for example, more material for remedial instruction is required. A more detailed study showed that this shortage of materials is relatively more obvious in poorer municipalities.

A need for textbooks and workbooks to contain more exercises which are applicable to practical situations, can be done in the

pupil's notebooks, and which review material previously learned was expressed.

Figure 5. Assessments of importance with respect to instructional materials in mathematics



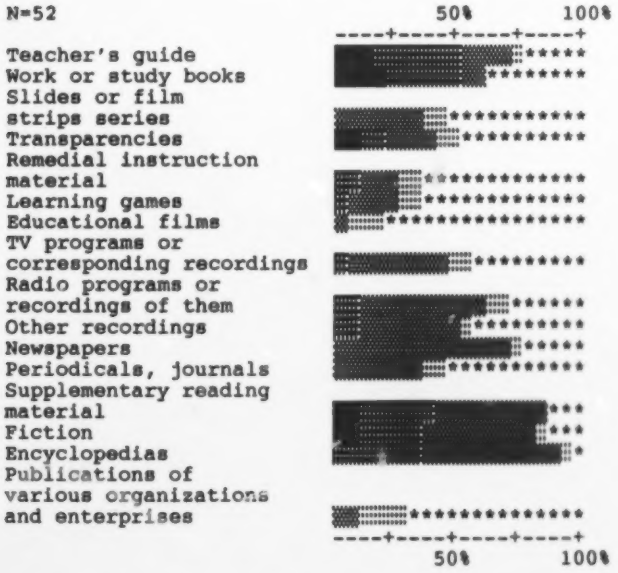
(▓ : very important, ▒ : important, ▒ : undecided, ▒ : quite unimportant, | : unimportant; one symbol means 5 %)

The textbook was considered to be the most appropriate instructional material for gifted and average pupils. Approximately 60 % of the teachers wanted more material appropriate for pupils who learn at different rates.

2.3. Finnish as mother tongue

Fifty-two teachers of Finnish as a mother tongue using books from five different publishers answered the inquiry. When the use of materials and the corresponding assessments of importance are compared (see Figures 6 and 7), it seems that more exercise books or work books, for example, are required. In this case the shortage is also more obvious in poorer municipalities.

Figure 6. Employment of supplementary materials in Finnish instruction (mother tongue, %)

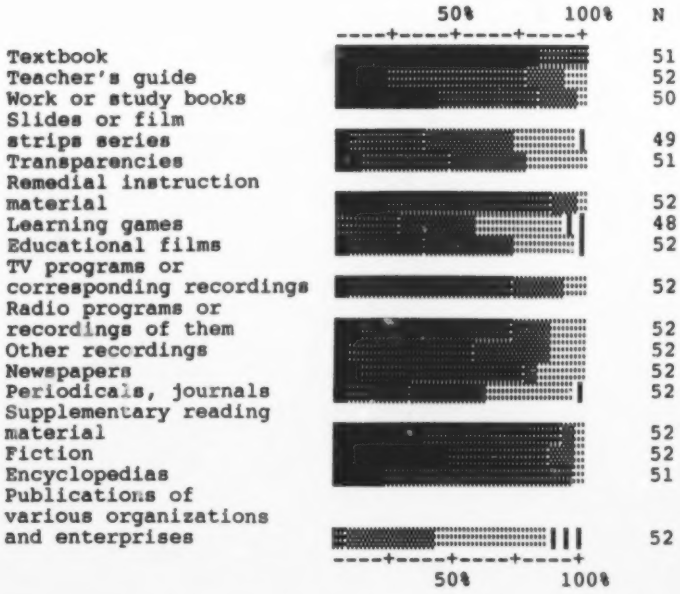


(▉ : daily, ▒ : weekly, ▓ : a few times a term, ⣿ : less frequently, * : not available; one symbol means 5 %)

The teachers of Finnish as a mother tongue require more revisionary exercises, exercises applicable to practical situations, exercises differing in their degree of difficult and exercises to be done in pupils' notebooks.

The textbook was the most appropriate instructional material for gifted or average pupils. Approximately 68 % of the respondents desired more material for students who learn at different rates.

Figure 7. Assessments of importance with respect to instructional materials in Finnish (mother tongue, %)



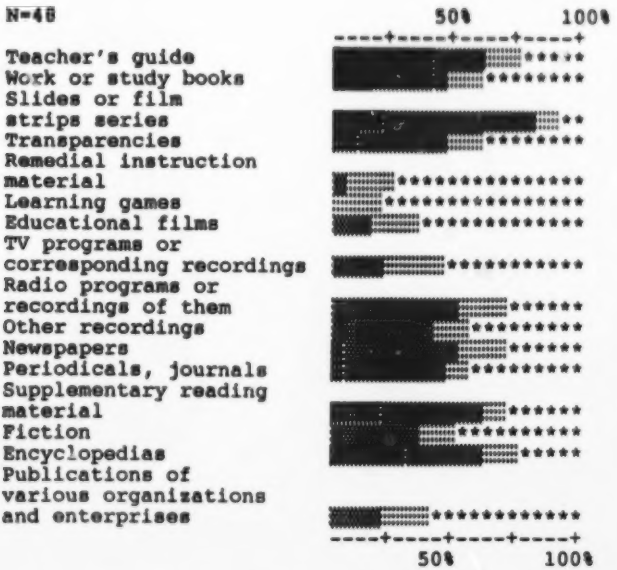
(▉ : very important, ▒ : important, ▓ : undecided, ▒ : quite unimportant, ▏ : unimportant; one symbol means 5 %)

2.4. Religion

Forty-eight religion teachers who had textbooks from five different publishers at their disposal answered the inquiry. More teachers' guides for such things as religion instruction were required, as may be seen if Figures 8 and 9 are compared with each other. The shortage is more obvious in poorer municipalities.

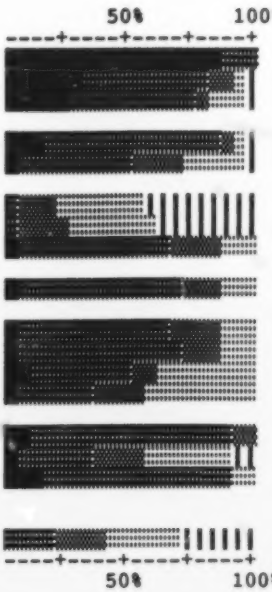
As regards different types of exercises, more exercises applicable to practical situations were required. According to the respondents, the textbook was the most appropriate material for gifted and average pupils. Approximately 39 % of the teachers wanted more material appropriate for pupils who learn at different rates.

Figure 8. Employment of supplementary materials in religion (%)



(▓ : daily, ▒ : weekly, ▒ : a few times a term, ▒ : less frequently, * : not available; one symbol means 5 %)

Figure 9. Assessments of importance with respect to instructional materials in religion (%)



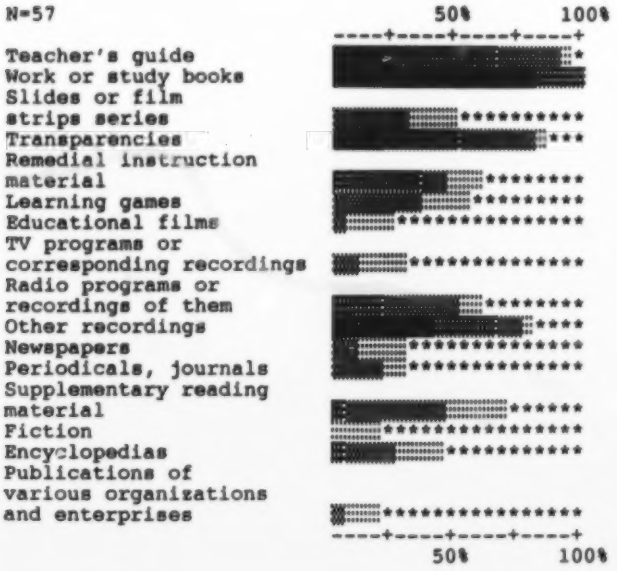
(▉ : very important, ▒ : important, ▓ : undecided, ▒ : quite unimportant, ▏ : unimportant; one symbol means 5 %)

2.5. Second language

Among the second language teachers, 56 were English teachers and one was a German teacher. They had at their disposal textbooks from four different publishers. There is no shortage of different types of materials, as may be seen in Figure 10.

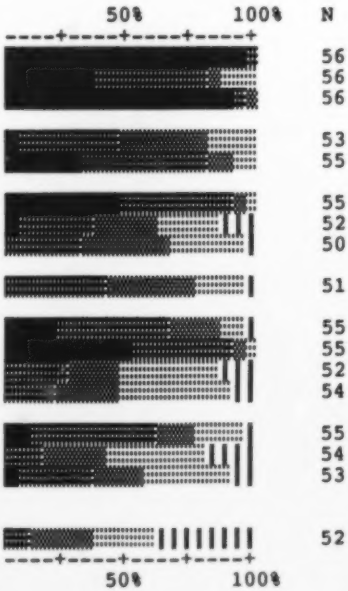
As regards different types of exercises, more revisionary exercises were required. The textbook was the most appropriate material for gifted and average pupils according to the respondents. Approximately 76 % of the teachers wanted material appropriate for pupils who learn at different rates.

Figure 10. Employment of supplementary materials in second language (%)



(▉ : daily, ▓ : weekly, ▒ : a few times a term, ▒ : less frequently, * : not available; one symbol means 5 %)

Figure 11. Assessments of importance with respect to instructional materials in second language (%)



(▉ : very important, ▒ : important, ▓ : undecided, ⣿ : quite unimportant, ▏ : unimportant; one symbol means 5 %)

2.6. Conclusions

On a general level the results show that

1. the textbook plays an important role in instruction.

2. There is a shortage of instructional materials. The situation is best in second language instruction.

3. More materials were required for poor and average pupils.

4. Textbooks were not made to last long enough.

5. Textbooks were revised too often.

3. RESEARCH CONCERNING UPPER SECONDARY SCHOOLS

3.1. Inquiry on ADP devices and instruction

At the request of the National Board of Schools a study was carried out concerning the ADP devices and ADP instruction in upper secondary schools in autumn 1981 (Niskanen, V: 1982a). The problems were:

1. What is the availability of ADP devices?

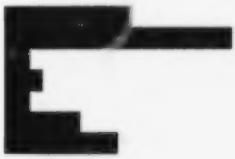
2. What are the conditions of ADP instruction?

Inquiry forms were sent to each of the 466 upper secondary schools; 416 (89.3 %) schools returned the forms. Of these, 42.6 % of the upper secondary schools reported having some sort of ADP devices at their disposal. The most often used brands are presented in Figure 12.

Figure 12. ADP devices according to brands (%)

N=173

	%
Apple II+	20.8
ABC-80	36.4
Sharp PC 1211	3.5
Commodore Pet	5.8
TRS-80 Radio Shack	4.0
Other	11.0
Various devices	18.5
	Σ 100.0



Most of the devices (88.3 %) had been acquired in the 1980s and they usually cost less than FIM 10 000. The available peripheral devices are shown in Figure 13.

Their own devices had been acquired by 64.8 % of the schools, 10.9 % had rented them, and the remaining 24.2 % had acquired them in some other way, e.g. by renting or by receiving donations of devices. The most common computer language was BASIC.

Figure 13. Available peripheral devices (%)

N=351

	%
Display terminal	31.3
Printer	27.1
Diskette unit	19.9
Hard disk unit	0.0
Plotter	1.1
Linkages to other devices	2.6
Other peripheral devices	17.9
	Σ 100.0

ADP devices were applied to three areas:

(i) ADP special-course instruction,

(ii) facilitating the instruction of different subjects, and

(iii) school administration.

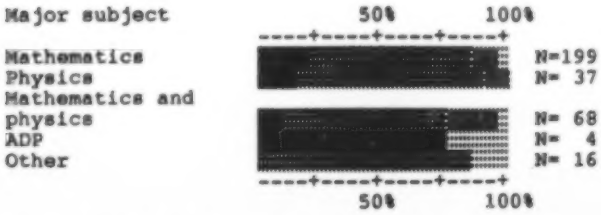
In ADP special-course instruction the devices were used by 85.5 % of the schools with the general aim of teaching the fundamentals of ADP and programming. The usual duration of a course was 40 hours at the most. One study period generally comprised working in groups, in pair and independently. In these courses 89 % of the schools used teachers from within the school.

In facilitating instruction the devices had been used by 71.7 % of the schools; they were mostly utilized in mathematics and physics. The most important applications were the solving and the illustrating of complicated mathematical problems.

ADP equipment had been used in administration in 30.6 % of the schools. The most typical fields of application were the evaluation of and maintenance of registers for pupils.

ADP special-courses and administrative applications aroused particular interest as concerns plans for using ADP equipment. Most (84.1 %) of the upper secondary schools reported having teachers capable of giving courses in ADP at their disposal. Their level of education is shown in Figure 14.

Figure 14. Major subjects of teachers and their studies in ADP



(▉ : ADP studies, ▒ : courses in ADP, ▓ : ADP studies and courses in ADP, ▤ : other studies; one symbol means 5 %)

On a general level the results show that:

1. At the time of the research the use of ADP devices was only beginning, because most of the equipment had been acquired in the 1980'.

2. As a natural result of item 1 very little information could be obtained on the use of ADP devices.

3. More computer software and their instructional materials, as well as more ADP devices were required.

4. Teachers of all but mathematical subjects had an insufficient knowledge of ADP. Consequently, they a growing need for training in that particular field.

5. The majority favored the control of the National Board of Schools in the procusement of ADP devices. Today the National Board of Schools has indeed given its recommendations concerning the acquisition of the devices.

3.2. Inquiry on instructional materials used in course-based upper secondary schools

Due to the changing over to the course-based upper secondary school a need was felt in the spring 1983 within the framework of the project

1. to study the experiences gained from instructional materials used in experimental upper secondary schools (Niskanen, V: 1982b).

Questionnaire forms consisting of six separate sections were sent to each of the 21 Finnish-speaking experimental upper secondary school. The first section was intended for all teachers. The second, third, fourth and fifth sections were intended for teachers of directed to mathematics, mother tongue, foreign languages and general subjects respectively. In the sixth section the opinions of pupils in the first year of upper secondary school were asked, with the principals having been asked to select these classes in such a way to obtain as varied a distribution as possible of the pupils' subject selections. Of these, 237 teachers (41.1 %) and 312 pupils (14.2 %) filled out the forms. The data obtained covered 54.4 % of the female teachers and 60.6 % of the female pupils.

The semantic differential technique (see Osgood, C. & al: 1957) was applied to the measurement in the first section of the questionnaire form to obtain a general view of the situation. In this case the assessments were presented by employing of a scale with seven values

1---2---3---4---5---6---7

in which the left hand side and the right hand side values indicated positive and negative assessment respectively. The midpoint of the scale (=4) was regarded as a neutral value.

The median of the teachers' general assessment was 2 and 97 % of the observations had values varying between 1 and 5. The most positive assessments obtained (median=2) concerned the criteria

'appropriateness to curriculum','up-to-dateness of subjects', and 'correctness of content and illustrations'. The most negative assessments (median=4, i.e. neutral) concerned criteria such as 'connections with other subjects' and 'possibility for the teacher to give his/her personal contribution to instruction'.

For further studies a factor analysis was also carried out in respect of the 18 criteria in the first section of the questionnaire form. Six factors were obtained:

(i) Pupil factor; i.e. teachers' opinions of textbook from pupil's standpoint.

(ii) Differentiation factor; i.e. appropriateness for students who learn at different rates.

(iii) Up-to-dateness - correctness factor.

(iv) Appropriateness to curriculum factor.

(v) Technical realization factor; i.e. emphasis laid on central issues, readability, illustrations etc.

(vi) Teacher factor; i.e. teacher's role in instructional process.

In sections 2 to 5 of the form an inquiry was carried out of teachers' assessments of each subject. These results show that mother tongue, English, religion and history/civics textbooks were mostly criticized for their excessive attention to detail, whereas only a few of the textbooks were considered too concise.

The English, Swedish, biology/geography and physics/chemistry textbooks were regarded as being the most appropriate for average pupils, and the textbooks in the other subjects were regarded as being the most appropriate for average and gifted pupils, but not for poor pupils.

The textbooks seemed to show a shortage of exercises of different types in almost every subject. Teachers of English and Swedish

appeared to be in the best position: about 1/3 of them considered the textbooks to contain too many exercises, even though in these cases as well, a need for different types of exercises was felt. The teachers of religion were also content with the number of different types of exercises in the textbooks.

According to pupils' assessments (sixth section)

1. biology and geography books were considered to be too extensive with respect to content.

2. Biology and geography books were regarded as the most up-to-date, whereas textbooks of some foreign languages, such as German, French and Russian textbooks, were considered to be the least up-to-date.

3. Biology and geography books were considered to be the best with respect to readability, technical realization and learning, whereas foreign language and religion books were considered to be the poorest.

4. In general, complaints were made about the courses being too hard and the rate of study too fast.

When comparing the assessments made by teachers and pupils, it may be noted that in certain cases their views resemble each other to a great extent: With respect to content, both groups considered history/civics textbooks to be too extensive and foreign language textbooks to be the most old-fashioned. Religion textbooks were regarded as the most difficult with respect to readability and biology/geography textbooks were considered to be the best with respect to technical realization. On the other hand, one half of the pupils took a neutral view to each criterion. It seems that in certain cases the pupils' assessments were influenced by the fact that the instructional materials were not yet in their final form.

3.3. Preferences concerning textbook criteria

Through studying textbook assessments concerning the course-based upper secondary school (Niskanen, V: 1982b), six basic criteria instead of the original eighteen were obtained by applying factor analysis. This gave rise to an examination of the following problems (Niskanen, V: 1983):

1. Is the number of previously established criteria sufficient for the assessment of textbooks?

2. How are these criteria ranked?

These criteria were slightly modified and, furthermore, for practical reasons, supplemented by two new criteria. The criteria to be studied were thus:

(i) Appropriateness to the curriculum.

(ii) Appropriateness of the textbook from the pupil's standpoint.

(iii) Technical realization of the textbook.

(iv) Extensiveness of the textbook contents.

(v) Appropriateness of the textbook from the teacher's standpoint.

(vi) Objectivity of the textbook.

(vii) Publisher of the textbook.

(viii) Writers of the textbook.

The respondents used the following scale with respect to each criterion

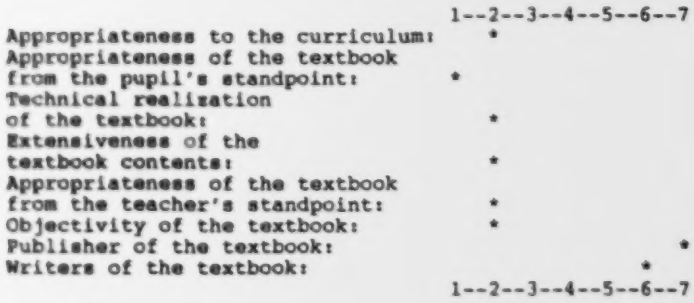
1---2---3---4---5---6---7

in which 1=very important and 7=completely insignificant.

Questionnaire forms were sent to the principals of 30 schools and they were asked to distribute the forms to teachers of theoretical subjects. An equal number of lower levels, upper levels and upper secondary schools were involved in the study. Of these, 29 schools returned a total number of 246 filled-out forms (61.5 % of the respondents were female).

Even though 40.2 % of respondents considered the number of criteria insufficient for textbook assessment, practically all of them proposed that a new criterion, along the lines of external qualities of textbook, should be included at general level in the criteria established at the early stages of the study. On the subject level, however, there was an apparent need for more criteria. The results obtained with respect to the preference of assessments of the criteria are shown in Figure 14.

Figure 15. Preferences concerning assessments of textbooks (medians)


1--2--3--4--5--6--7
Appropriateness to the curriculum:
Appropriateness of the textbook from the pupil's standpoint:
Technical realization of the textbook:
Extensiveness of the textbook contents:
Appropriateness of the textbook from the teacher's standpoint:
Objectivity of the textbook:
Publisher of the textbook:
Writers of the textbook:
1--2--3--4--5--6--7

(1 = very important, 7 = completely insignificant)

The importance of the publisher and author of the textbook seems suspiciously small, so in this field further studies are apparently required.

After studying the correlation coefficients and each school level respectively, it may be concluded that:

1. At the lower level of comprehensive school less attention was drawn to the technical realization than to other levels.

2. The higher the level of education, the less attention was drawn to the appropriateness of the textbook from the teacher's standpoint.

3. The objectivity of the textbook was most emphasized in upper secondary school and least at the upper level of comprehensive school.

4. The higher the level of education, the greater the emphasis given to the contribution of the publisher of the textbook.

5. The higher the level of education, the greater the emphasis given to the importance of writers of the textbook.

After studying each subject concerned, it was observed that

1. appropriateness to the curriculum was most emphasized in religion, and least emphasized in mathematics and biology/geography.

2. Appropriateness for the pupil was most emphasized in mother tongue and religion, and least in mathematics.

3. Technical realization was most emphasized in foreign languages, and least in history and in biology/geography.

4. In mathematics the extensiveness of contents was given the least emphasis.

5. Appropriateness for the teacher was emphasized most in history, and least in biology/geography.

6. Objectivity was emphasized most in religion, and least in mathematics and in biology/geography.

7. In mother tongue the importance of the publisher was given the most emphasis.

8. The contribution of the writers of the textbook was most emphasized in biology/geography, and least in mathematics and foreign languages.

It was assumed in advance that the criteria given would not correlate with each other, but this was not completely the case.

The unamity of respondents was estimated by applying group decision theory. The results showed that rankings concerning the criteria were not unanimous.

4. SUMMARY

In this report the following aspects have been considered:

1. A brief concept analysis devoted to instructional materials was performed.

2. Results concerning teachers' assessments of instructional materials in comprehensive schools have been presented.

3. Results concerning the availability of ADP devices and the conditions of ADP instruction in upper secondary schools have been presented.

4. Experiences gained by teachers and pupils from instructional materials in course-based upper secondary schools have been presented.

5. The study mentioned in item 4 provided a basis for establishing some principal criteria concerning the assessment of instructional materials. The results obtained by examining the rankings of these criteria have been presented.

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